Center Innovation Fund: JSC CIF

Chemistry and Thermodynamics of Solid Waste Streams used in Waste-to-Energy (WTE) Systems

Completed Technology Project (2013 - 2013)

Project Introduction

In spite of our best efforts to minimize the amount of disposable supplies (and the associated packaging) used during space missions, the accumulation of solid wastes is an inevitable consequence of mission activity. That waste will occupy precious cargo or living space within the habitat unless it is properly managed. Converting solid wastes to an energy source presents a potential solution to this problem. Waste-to-energy (WTE) presents a viable solution to this problem in that the solid wastes can be converted into an energy source for use during a mission. Because this fuel is generated using available resources, it significantly offsets the initial mission logistics requirements, and provides several operational benefits and opportunities. WTE also addresses several terrestrial challenges related to our energy needs, environmental conservation, and our need to more efficiently use land resources. This study will produce a detailed chemical and thermodynamic model of a deep-space exploration waste stream. The model will be used in designing technologies for WTE systems within the Advanced Exploration Systems (AES) program and can also provide a starting point for commercial WTE systems.

Anticipated Benefits

Waste-to-energy (WTE) addresses a number of terrestrial challenges by 1) promoting green energy and fostering energy independence, 2) optimizing land use by freeing space otherwise allocated to landfills, and 3) providing a less toxic means for destroying municipal solid waste (MSW). A number of materials from typical MSW streams can be converted to methane that can be used as an energy source. These converted materials demonstrate the advantages of converting waste to methane vs. current waste management strategies: landfilling and incineration. Conversion to liquefied methane reduces the footprint of waste over landfilling (by ~40%), and provides an opportunity to recover more energy from MSW (~120% more) than incineration.

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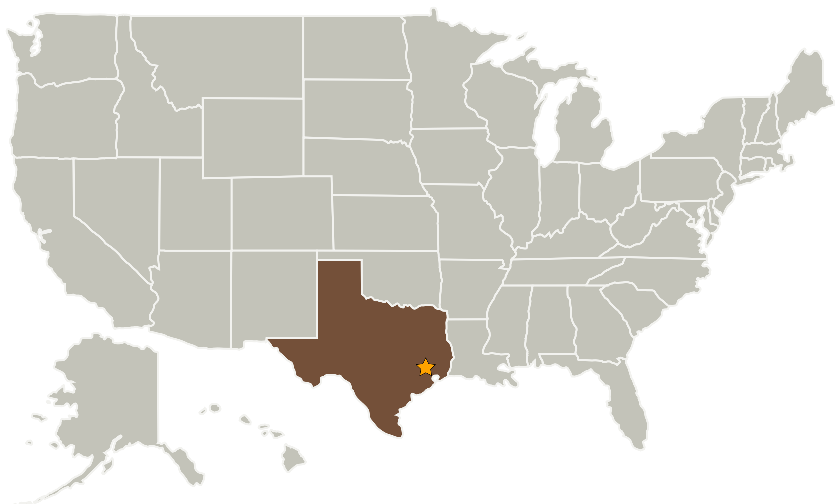
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Jacobs Engineering Group, Inc.	Supporting Organization	Industry	Dallas, Texas

Primary U.S. Work Locations
Texas

Links

NTR 1
(https://ntr.ndc.nasa.gov/ntr/viewTech.html?fn=/data/other/review_bin/technology/accepted/d018fd1c_4bbf_7ff4_413f_a7c32e1abe33.xml)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Project Manager:

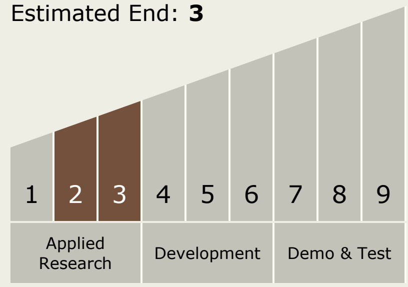
Rama K Allada

Principal Investigator:

Rama K Allada

Technology Maturity (TRL)

Start: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - └ TX06.1.5 ECLSS Modeling and Simulation Tools